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Editorial

# Designing high quality system/software architectures

## 1. Introduction

Just about everything has an architecture — be it a software system, an organization, or even a human body — consisting of parts and interactions among the parts. Of increasingly crucial concerns in Software Engineering are the system architecture which describes the parts, and interactions between the parts, of the system — be it the enterprise architecture in which the projected software system is to function or the architecture of the projected software system itself.

The theme of the 6th International Workshop on System/Software Architectures (IWSSA'07) was designing high quality in the (potentially distributed) system/software architectures. Inevitably most of the properties of the final system/software are determined, and exhibited, by the architecture, hence the quality properties of the architecture are becoming a central concern in order to rationalize the quality of the final system/software.

However, representing the concerns for high quality architectures and designing architectures that can indeed be shown to meet such concerns presently is anything but systematic. The pressing need in the industry is to represent the numerous types of quality properties and design them in architectures, not in an isolated manner but more in a coherent manner, and with traceably adequate levels of abstractions.

Researchers and practitioners in both academia and industry were invited to submit papers and participate in the 6th International Workshop on System/Software Architectures (IWSSA'07), which, as has been with its series of workshops in the past, was intended to provide an international forum for researchers and practitioners to exchange ideas and discuss the problems, as well as solutions, in the fields of system architecture and software architecture.

The 6th International Workshop on System/Software Architectures (IWSSA'07) was organized in June, 2007, in Las Vegas, as a part of the International Conference on Software Engineering Research and Practice, 2007. IWSSA'07 was a huge success, considering the quality of papers that it attracted, the relevance of the papers to the workshop topic, and the audience participation.

## 2. Topics

A main theme of this workshop was about techniques and methodologies for developing high quality system/software architectures that are secure, interoperable, adaptive, responsive, reliable, ubiquitous, dependable, self-healing, etc.

The topics for the papers included, but not limited to:

- roles of enterprise/system architectures in Requirements Engineering
- roles of Requirements Engineering in enterprise architecting
- models of, and model-driven approaches for, enterprise/software architectures
- applications, and case studies, of enterprise/software architectures
- engineering quality in architectures to include characteristics such as security, interoperability, adaptability, responsiveness, ubiquity, reliability, dependability, self-healing ability, performance, usability, safety, etc.
- methodologies for mapping between the enterprise architecture and the corresponding software architecture
- software architectures and design theories
- software architecture maintenance and evolution
- formal validation and verification techniques
- metrics for architectures
- object-oriented/aspect-oriented/goal-oriented/agent-oriented/ scenario-based approaches to enterprise/software architecture development
- service-oriented architectures (SOA)
- COTS/GOTS/Component/Middleware-Based development methodologies for enterprise/software architectures

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## 3. Selected papers

Three papers from those presented at IWSSA'07 were chosen for inclusion in this special issue. All the three papers in this special issue were based on audience interest, and were extended and revised for this special issue. While the first two papers involved two rounds of reviews, the third paper was handled entirely by the Editor-in-Chief of the journal of Computer Science of Programming separately from the rest. All the three papers were reviewed by at least three reviewers, from members of the IWSSA'07 Program Committee and/or additional external reviewers. In our opinion, these papers give a general overview of the problems involved in building quality system and software architectures for different domains.

The first paper entitled "Experience of Building an Architecture-Based Generator Using GenVoca for Distributed Systems", by Chung-Horng Lung, Pragash Rajeswaran, Sathyanarayanan Sivadas, and Theleepan Sivabalasingam, proposes an architecture-centric generative approach in facilitating architectural prototyping and evaluation. A key motivation behind this work has to do with selecting the architecture that meets the requirements, both functional and non-functional, when there exist so many uncertainties in the early stage of software development. Architectural prototyping would be useful for supporting the evaluation of alternative architectures and balancing different architectural qualities, while a generative approach would support software automation. This paper also presents an empirical experience in raising the level of abstraction from programming to architecture, for distributed and concurrent systems, using a generative programming approach, called GenVoca.

The second paper entitled "Aspect-oriented Model-driven Code Generation: a Graph Transformation Approach", by Jeannette Bennett, Kendra Cooper, and Lirong Dai, proposes a model-driven code generation approach based on graph transformations for aspect-oriented software development. This approach has two main transformation activities. The first activity transforms a visual (graphical) model of the aspect-oriented design, expressed as a UML profile for the design components, into a formal, text-based notation, in terms of XML. This activity is model driven, since the transformation uses the XML metamodel to ensure the output complies with the language. The second activity transforms the XML model into AspectJ source code, which is also model driven since the transformation uses the AspectJ metamodel to ensure the output complies with the language. A tool is presented in the paper, for the transformations from the extended UML model to XML and from XML to AspectJ, using graph transformation algorithms. The paper describes a banking system example, for both illustration and validation.

The third paper entitled "Ontology-driven Analysis of UML-Based Collaborative Processes using OWL-DL and CPN", by Manuel Noguera, María V. Hurtado, María Luisa Rodríguez, Lawrence Chung, and José Luis Garrido, addresses modeling business processes that involve the collaborative participation of different teams within and outside an organization. This paper notes that UML offers a human-friendly visual representation of a rich set of structural and behavioral views, but lacks clear semantics, while the Web Ontology Language (OWL) offers clearly-defined semantics, hence being amenable to automatic analysis and reasoning, but is less human-friendly than, and also perhaps not as rich as, the UML notation — especially concerning processes or activities. The paper views the UML and the OWL languages as being complementary to each other, and exploits their relative strengths. The paper provides a set of (formal) mapping rules intended to translate UML activity diagrams into an OWL-ontology, and describes how to construct executable models using the Colored Petri Nets (CPN) formalism. The paper describes a mortgage granting system as a case study.

We hope the readers enjoy the papers in this special issue on the important topic of quality system and software architectures.

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